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*Managing the Risks of
Organizational Accidents*

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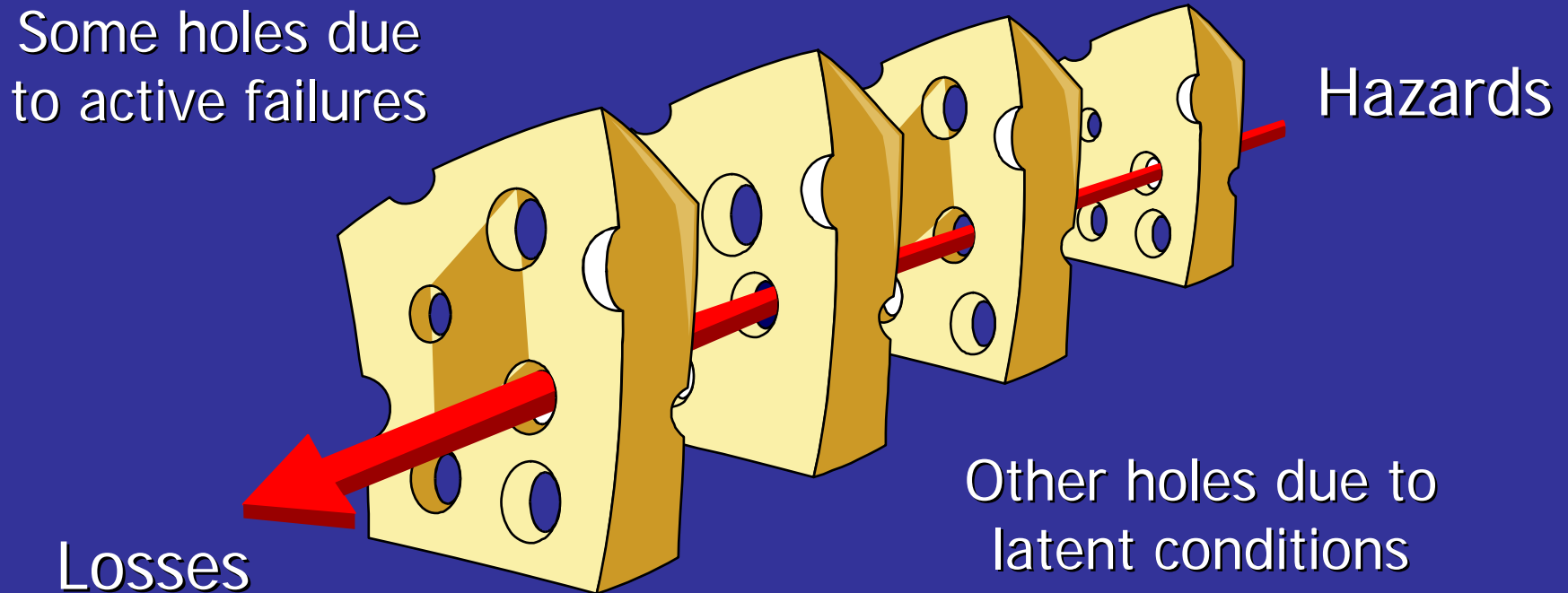
Overview

- On the nature of organizational accidents.
- Ever-widening search for upstream factors.
- Protection versus production: an ever-present conflict.
- Some pathologies associated with conflict.
- Investigative biases.
- Making system changes: a continuum

Two kinds of accidents

| <i>Individual accidents</i> | <i>Organizational accidents</i> |
|--|---|
| Frequent Limited consequences Few or no defenses Limited causes Slips, trips and lapses Short 'history' | Rare Widespread consequences Many defenses Multiple causes Judging and deciding Long 'history' |

A model of organizational accidents (The 'Swiss cheese')



Successive layers of defenses, barriers, & safeguards

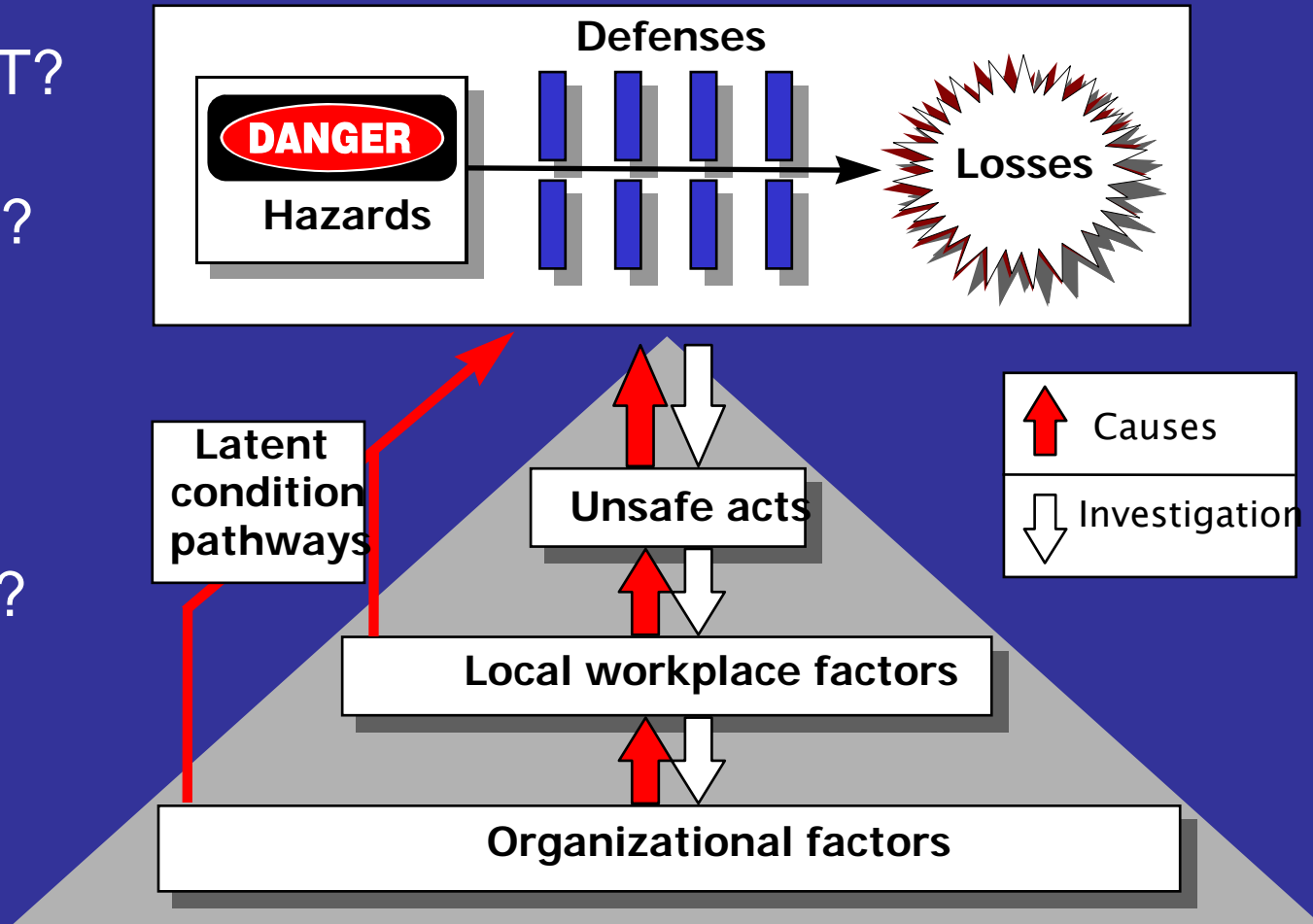
What? How? Why?

A retrospective process

WHAT?

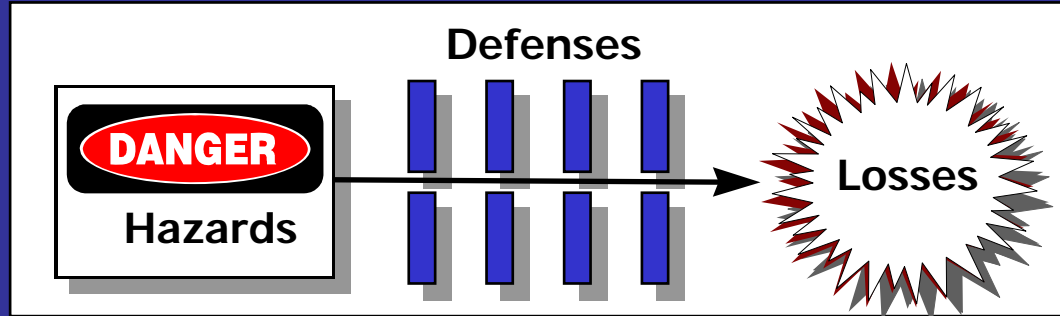
HOW?

WHY?

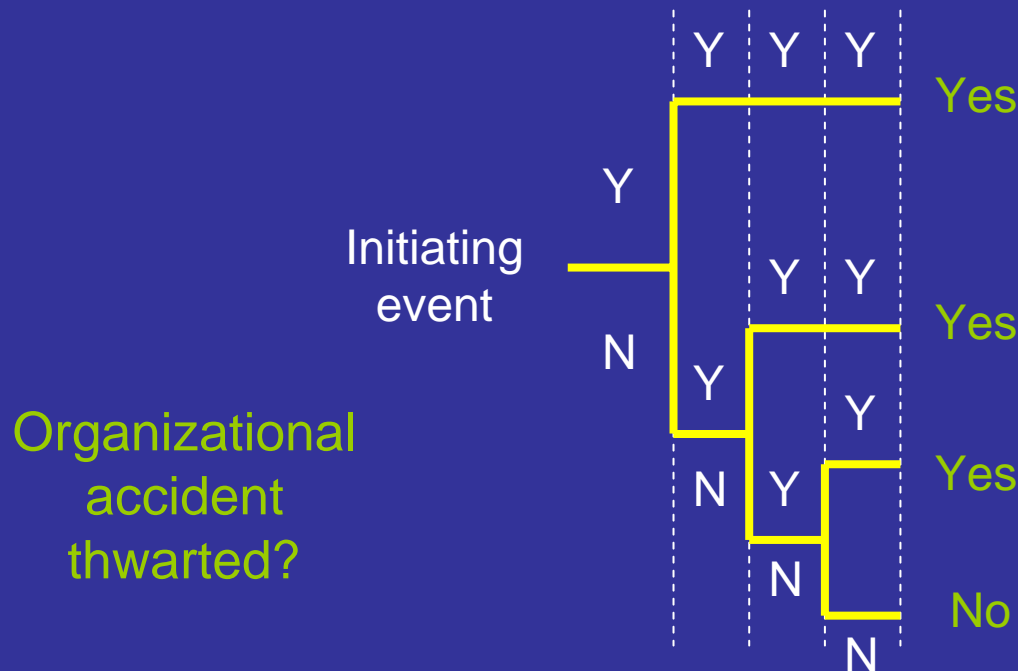


Swiss cheese and PRA event tree

A prospective process

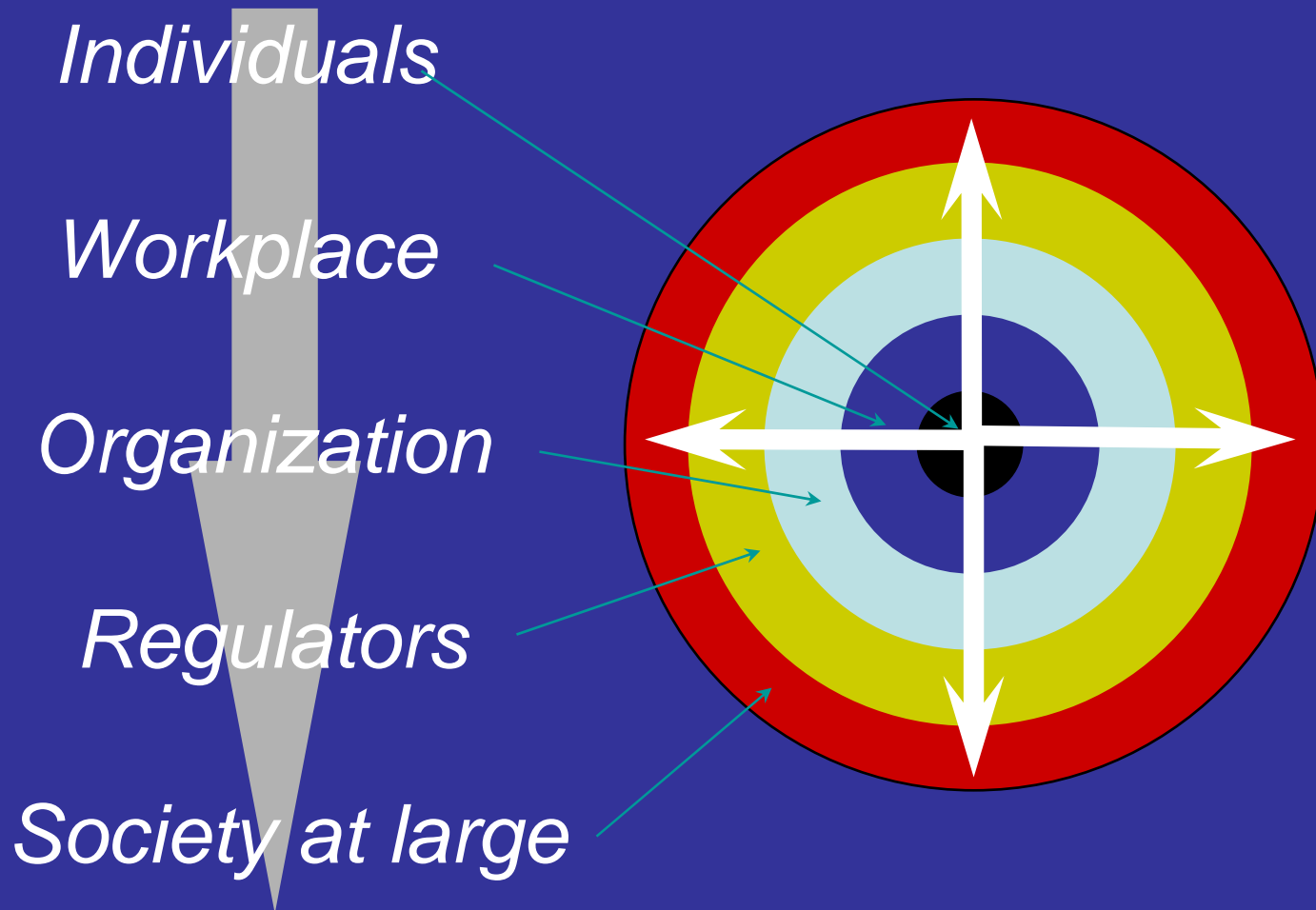


Defense functions as intended?

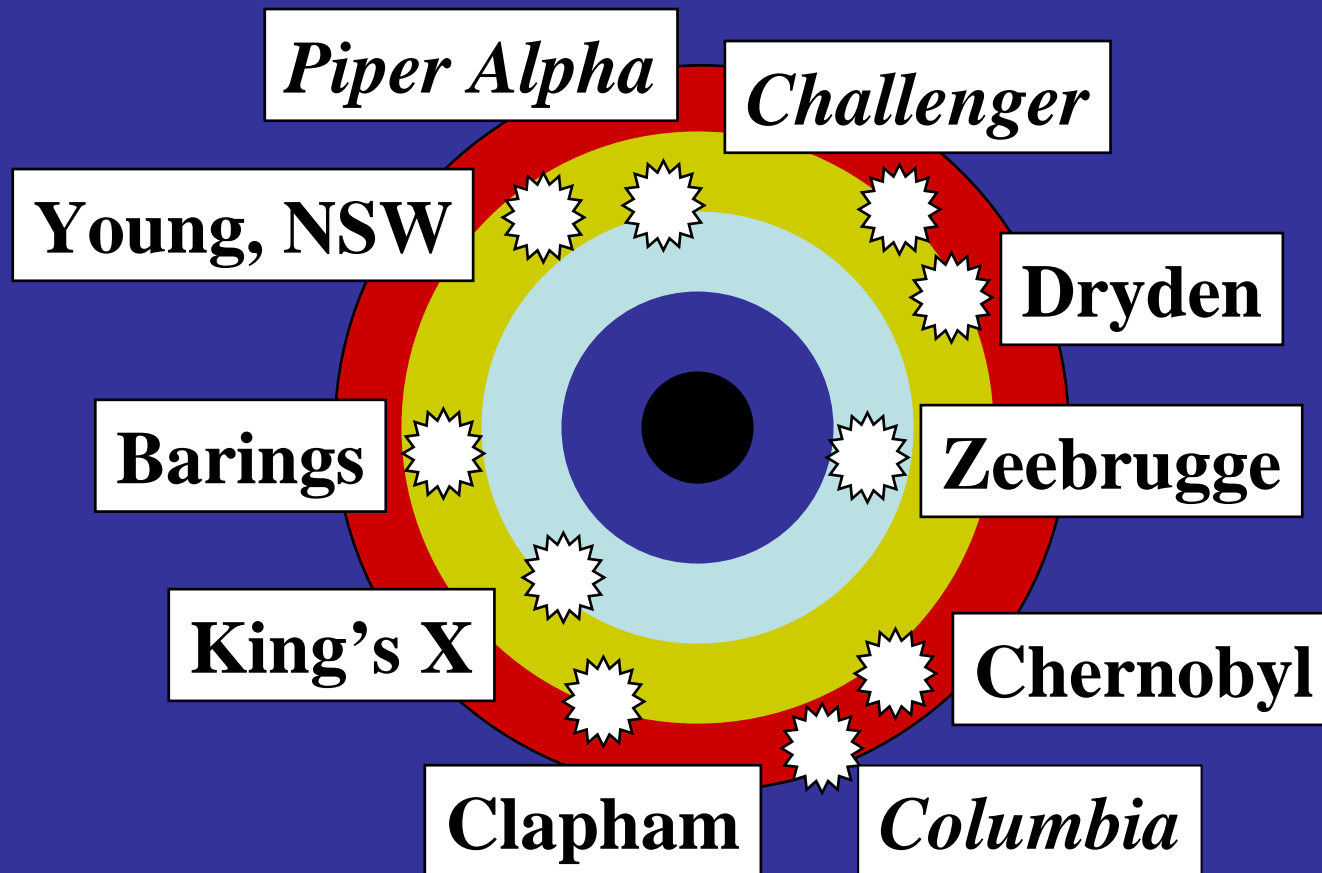


Outcomes expressed as probabilities

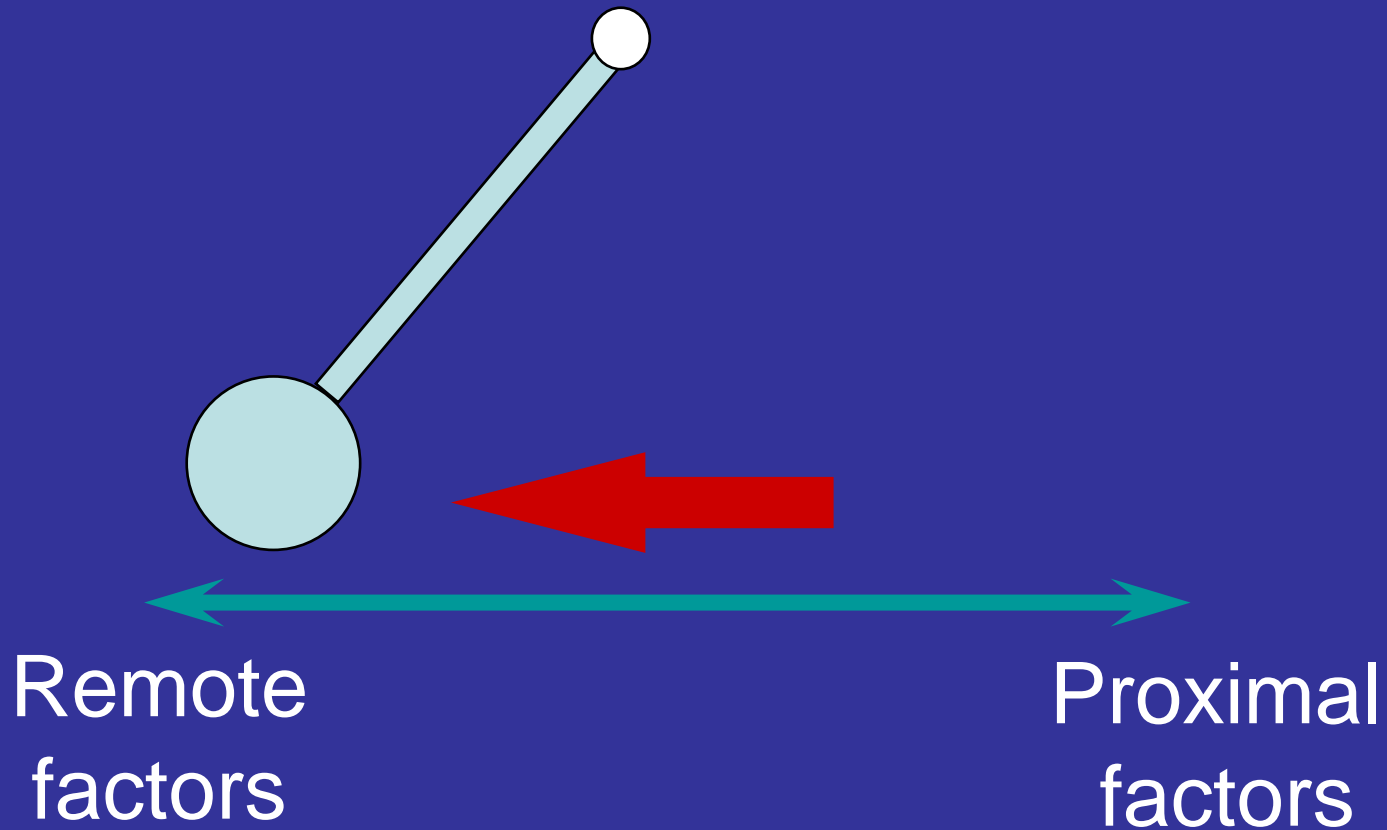
Ever-widening search for the 'upstream' factors



Echoed in many hazardous domains



But has the pendulum swung too far?



CAIB Report (Ch. 5)

‘The causal roots of the accident can be traced, in part, to the turbulent post-Cold War policy environment in which NASA functioned during most of the years between the destruction of *Challenger* and the loss of *Columbia*.’

1990s: leaner and meaner years for everyone

- Reduced public funding
- Continuous reorganisation
- Decentralisation
- Quality assurance and TQM
- 'Faster, better, cheaper'
- Privatisation
- Downsizing, etc.

Remote factors: some concerns

- They have little causal specificity.
- They are outside the control of system managers, and mostly intractable.
- Their impact is shared by many systems.
- The more exhaustive the inquiry, the more likely it is to identify remote factors.
- Their presence does not discriminate between normal states and accidents; only more proximal factors do that.

Two risk-related principles

- **ALARP** principle: Keep your risks as low as reasonably practicable.
- **ASSIB** principle: And still stay in business!

A delicate balance

Protection data

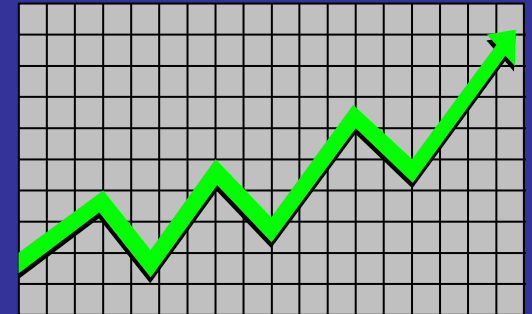
- delayed
- intermittent
- ambiguous
- unreliable



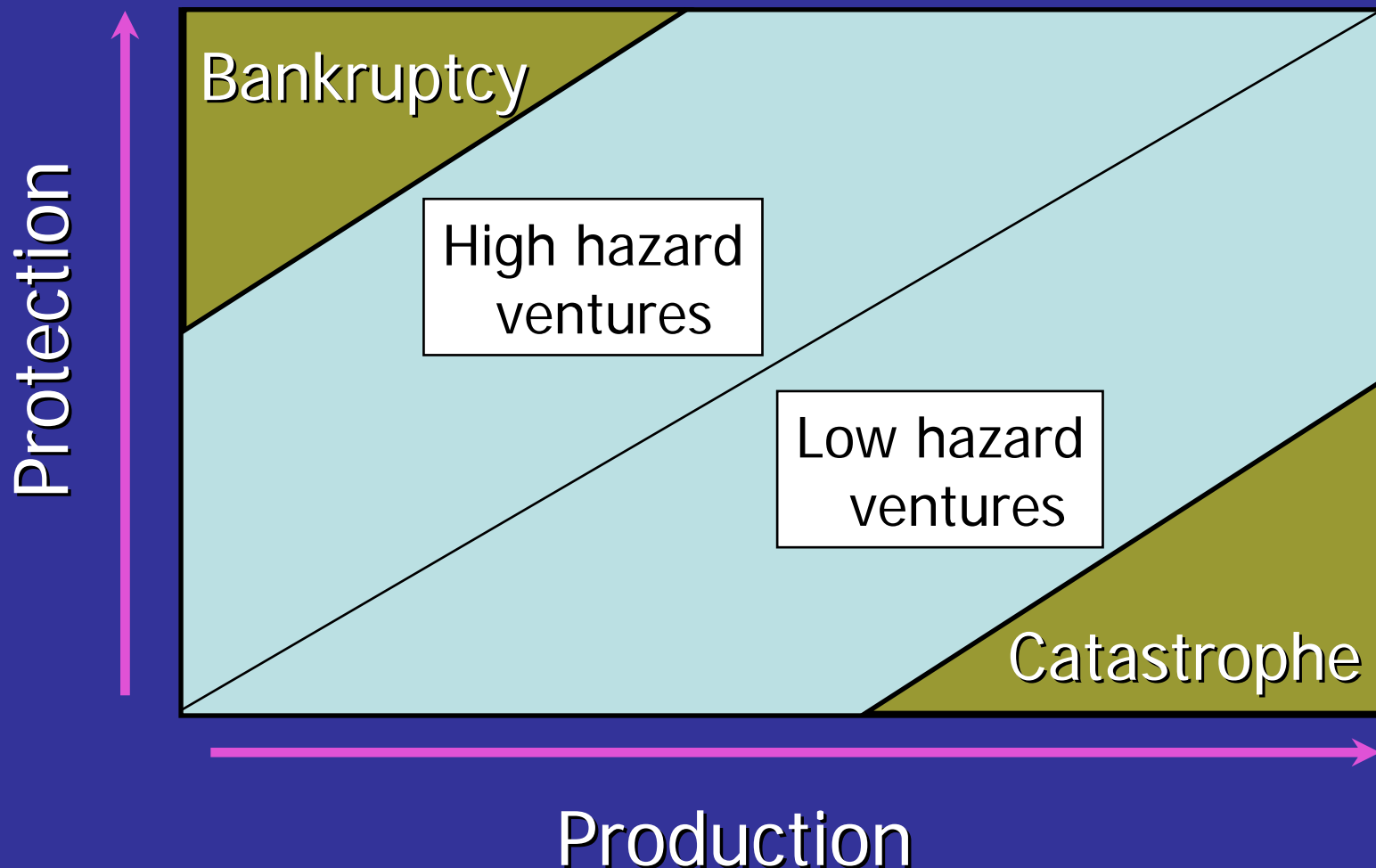
Production data

- immediate
- continuous
- unambiguous
- reliable

Bad events



Production and protection: Each have their limits



The production-protection tension creates some pathologies

- Trading off improved defences for increased production.
- Keeping your eye on the wrong ball.
- Attempting too much with too little: the 'can-do' syndrome.
- Believing that past non-events predict future non-events (forgetting to be afraid).

The process not the people

- CAIB chapters in answer to 'Why?'
 - From *Challenger* to *Columbia*
 - Decision making [and communication]
 - Organizational [and cultural] causes
 - History as cause

Investigative biases

- Hindsight bias
- Symmetry bias
- Outcome bias
- Counterfactual fallacy

Hindsight bias

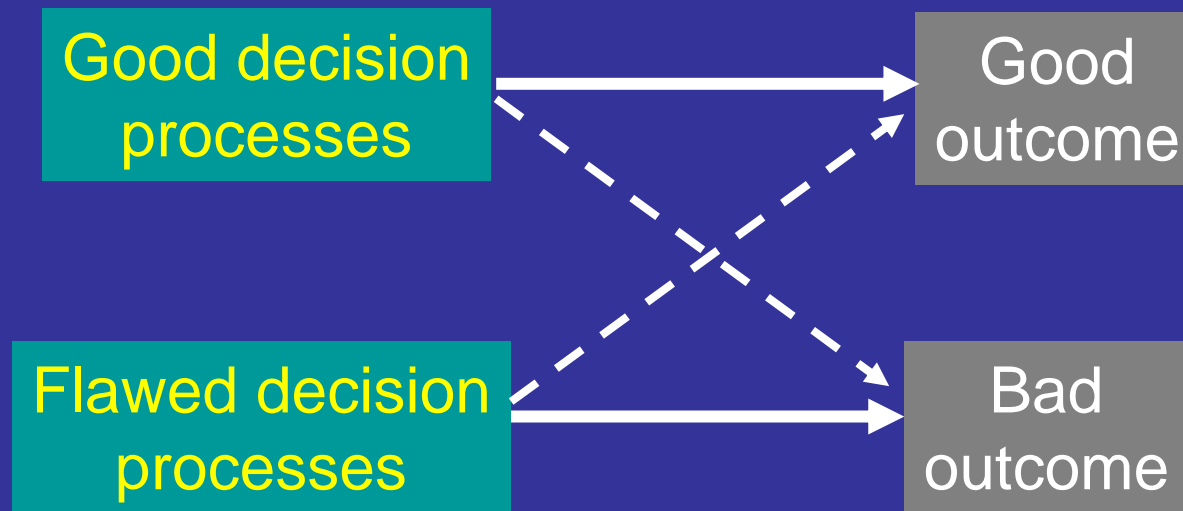
- ‘Creeping determinism’: Observers of past events exaggerate what other people should have been able to anticipate in foresight.
- In retrospect, the lines of causality appear to converge on the event. No such obvious convergence existed at the time.
- A warning is only a warning if you know what kind of bad event you’re going to have.

Symmetry bias

- Sir Francis Bacon (1620): *'The human mind is prone to suppose the existence of more order and regularity in the world than it finds'*
- One way of simplifying the world is to presume a symmetry of magnitude between cause and consequences.
- Perceptions of *Columbia* were compounded by knowledge of *Challenger* and the apparent similarities between them.

Outcome bias

Relates to the influence of outcome knowledge upon evaluations of prior decision quality.



We naturally assume there is correspondence. (But history teaches us otherwise.) Leads to revamping good decision processes.

Flight Readiness Review & Mission Management Team

- The context:
 - STS-107 was a low-orbit, low-priority science flight.
 - All 100+ prior flights had sustained foam damage.
 - In 22 years all but one had landed safely.
 - The *Challenger* tragedy had other causes.
 - Strong schedule pressure from Feb 19 2004 deadline.
 - Engineering concerns not really heard during mission.
- Communication failed and the outcome was bad, but was the decision making process really flawed?

Counterfactual fallacy

- All accident investigations reveal systemic shortcomings.
- They are present in all organizations.
- It is then a short step to argue that these latent 'pathogens' caused the accident.
- There are always organizational interventions that could have thwarted the accident sequence.

More on counterfactuals

- But their absence does not demonstrate a causal connection.
- The fallacy: If things had been different, then the accident would not have happened; *ergo*, the absence of such differences caused the accident.
- Organizational factors are conditions rather than causes.

System change: a continuum

- Don't accept the need for change.
- Accept need, but don't know where to go.
- Know where to go, but not how to get there.
- Know how, but doubt it can be achieved.
- Make changes, but they are cosmetic only.
- Make changes, but no benefits—model doesn't align with real world.
- Model aligns today, but not tomorrow.
- Successful transition—model keeps in step with a changing world.

Conclusions

- *Columbia* (like *Challenger*) was an organizational accident.
- The organizational and cultural conditions preceding *Columbia* are well covered in the CAIB Report. BUT . . .
- Need to distinguish between what needs fixing and what actually caused *Columbia* tragedy.
- Investigators have to 'digitize' a complex analogue event. Inevitably, there is distortion.
- Many pitfalls in changing a system.